

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1 1-90 (Canceled).

1 91. (Currently amended) A method of caching a data object, comprising:
2 receiving at a first cache of a plurality of cooperating caches a first data
3 object of a domain of data objects;
4 if said first data object is owned by the first cache, storing said first data
5 object as primary content in the first cache;
6 if said first data object is owned by another cache in the plurality of
7 caches, determining on the basis of a set of dynamic criteria whether to store said
8 first data object as secondary content in the first cache, and in the case of such a
9 decision storing said first data object as secondary content in the first cache; and
10 ~~if so, storing said first data object as secondary content in the first cache;~~
11 wherein said first data object is owned by one and only one of the plurality
12 of caches; ~~and~~
13 wherein a ratio between primary content and secondary content in the first
14 cache is allowed to fluctuate;
15 wherein each of the plurality of cooperating caches in the system is
16 configured to save previous configurations of the cache system, so that when the
17 configuration of the cooperating caches changes, the system can quickly revert to
18 a saved configuration; and

19 wherein knowledge of previous configurations and content digests sent by
20 cooperating caches are used to operate a warm-up phase that allows new caches to
21 initiate rapidly as they enter the system.

1 92. (Previously presented) The method of claim 91, further comprising:
2 identifying one of the plurality of caches as the owner of said first data
3 object.

1 93. (Previously presented) The method of claim 92, wherein said
2 identifying comprises:
3 hashing an identifier of said first data object to produce a hash value; and
4 mapping said hash value to one of said plurality of caches.

1 94. (Previously presented) The method of claim 91, wherein said receiving
2 comprises receiving said first data object from said other cache in the plurality of
3 caches.

1 95. (Previously presented) The method of claim 91, wherein said set of
2 dynamic criteria includes a popularity of said first data object.

1 96. (Previously presented) The method of claim 91, wherein said set of
2 dynamic criteria includes a utilization of the first cache.

1 97. (Previously presented) The method of claim 91, wherein said set of
2 dynamic criteria includes a size of said first data object.

1 98. (Previously presented) The method of claim 91, further comprising:
2 removing a cached data object from the first cache;
3 wherein said cached data object is selected based on one or more criteria.

1 99. (Previously presented) The method of claim 98, wherein said one or
2 more criteria include popularity;
3 wherein said popularity is measured as one or more of:
4 a number of requests for said cached data object; and
5 a frequency of requests for said cached data object.

1 100. (Previously presented) The method of claim 98, wherein said one or
2 more criteria include validity.

1 101. (Previously presented) The method of claim 98, wherein said one or
2 more criteria include age.

1 102. (Previously presented) The method of claim 98, wherein said one or
2 more criteria include size.

1 103. (Previously presented) The method of claim 98, wherein said one or
2 more criteria include ownership.

1 104. (Previously presented) The method of claim 98, wherein said one or
2 more criteria include a cost of retrieving said cached data object from one of an
3 origin server and a second cache in the plurality of caches.

1 105. (Previously presented) The method of claim 98, wherein said one or
2 more criteria include a level of storage input/output activity at the first cache.

1 106. (Previously presented) The method of claim 98, wherein said one or
2 more criteria include a level of communication activity at the first cache.

1 107. (Previously presented) The method of claim 98, wherein said one or
2 more criteria include a level of processor activity at the first cache.

1 108. (Previously presented) The method of claim 91, further comprising:
2 propagating invalidation of said first data object between the first cache
3 and a second cache.

1 109. (Previously presented) The method of claim 91, further comprising:
2 exchanging a configuration of the plurality of cooperating caches between
3 the first cache and a second cache.

1 110. (Previously presented) The method of claim 91, further comprising:
2 re-configuring ownership of the domain of data objects in response to the
3 removal of a cache from the plurality of cooperating caches.

1 111. (Previously presented) The method of claim 91, further comprising:
2 re-configuring ownership of the domain of data objects in response to the
3 addition of a cache to the plurality of cooperating caches.

1 112. (Currently amended) A computer readable storage medium storing
2 instructions that, when executed by a computer, cause the computer to perform a
3 method of caching a data object, the method comprising:
4 receiving at a first cache of a plurality of cooperating caches a first data
5 object of a domain of data objects;
6 if said first data object is owned by the first cache, storing said first data
7 object as primary content in the first cache;
8 if said first data object is owned by another cache in the plurality of
9 caches, determining on the basis of a set of dynamic criteria whether to store said

10 | first data object as secondary content in the first cache, and in the case of such a
11 | decision storing said first data object as secondary content in the first cache; and
12 | ~~if so, storing said first data object as secondary content in the first cache;~~
13 | wherein said first data object is owned by one and only one of the plurality
14 | of caches; and
15 | wherein a ratio between primary content and secondary content in the first
16 | cache is allowed to fluctuate;
17 | wherein each of the plurality of cooperating caches in the system is
18 | configured to save previous configurations of the cache system, so that when the
19 | configuration of the cooperating caches changes, the system can quickly revert to
20 | a saved configuration; and
21 | wherein knowledge of previous configurations and content digests sent by
22 | cooperating caches are used to operate a warm-up phase that allows new caches to
23 | initiate rapidly as they enter the system.

1 | 113. (Currently amended) A method of caching data objects in a plurality
2 | of cooperating caches, comprising:
3 | partitioning a set of data objects among a plurality of cooperating caches,
4 | wherein each of said caches receives ownership of a subset of said data objects;
5 | caching one or more data objects of a first subset of said data objects at a
6 | first cache having ownership of said first subset;
7 | caching one or more data objects of a second subset of said data objects at
8 | the first cache as secondary content, wherein a second cache in the cluster owns
9 | said second subset;
10 | wherein a ratio between the first subset and the second subset in the first
11 | cache is allowed to fluctuate;
12 | receiving at the first cache a first request for a first data object in said
13 | second subset of data objects;
14 | receiving said first data object from the second cache; ~~and~~

15 caching said first data object at the first cache only if said first data object
16 satisfies one or more of a predetermined set of criteria;
17 wherein each of the plurality of cooperating caches in the system is
18 configured to save previous configurations of the cache system, so that when the
19 configuration of the cooperating caches changes, the system can quickly revert to
20 a saved configuration; and
21 wherein knowledge of previous configurations and content digests sent by
22 cooperating caches are used to operate a warm-up phase that allows new caches to
23 initiate rapidly as they enter the system.

1 114. (Previously presented) The method of claim 113, wherein said
2 caching said first data object comprises caching said first data object if said first
3 data object has a threshold level of popularity.

1 115. (Previously presented) The method of claim 113, wherein said
2 caching said first data object comprises caching said first data object if the first
3 cache has capacity to cache said first data object without first removing another
4 data object.

1 116. (Previously presented) The method of claim 113, further comprising:
2 removing one or more cached data objects from the first cache, wherein a
3 subset of said set of criteria is used to select said one or more cached data objects.

1 117. (Previously presented) The method of claim 113, wherein said
2 predetermined set of criteria includes a popularity of said first data object.

1 118. (Previously presented) The method of claim 113, wherein said
2 predetermined set of criteria includes a validity of said first data object.

1 119. (Previously presented) The method of claim 113, wherein said
2 predetermined set of criteria includes a size of said first data object.

1 120. (Previously presented) The method of claim 113, wherein said
2 predetermined set of criteria includes an age of said first data object.

1 121. (Previously presented) The method of claim 113, wherein said
2 predetermined set of criteria includes a cost of retrieving said first data object
3 from an origin server.

1 122. (Previously presented) The method of claim 113, wherein said
2 predetermined set of criteria includes a measure of the utilization of the first
3 cache.

1 123. (Previously presented) The method of claim 113, further comprising:
2 receiving an invalidation message regarding said first data object at one of
3 the first cache and the second cache; and
4 communicating said invalidation to the other of the second cache and the
5 first cache.

1 124. (Previously presented) The method of claim 113, further comprising:
2 automatically re-partitioning ownership of the set of data objects upon
3 failure of one of the cooperating caches.

1 125. (Previously presented) The method of claim 113, further comprising:
2 automatically re-partitioning ownership of the set of data objects upon the
3 addition of a cache to the plurality of cooperating caches.

1 126. (Currently amended) A computer readable storage medium storing
2 instructions that, when executed by a computer, cause the computer to perform a
3 method of caching data objects in a plurality of cooperating caches, the method
4 comprising:
5 partitioning a set of data objects among a plurality of cooperating caches,
6 wherein each of said caches receives ownership of a subset of said data objects;
7 caching one or more data objects of a first subset of said data objects at a
8 first cache having ownership of said first subset;
9 caching one or more data objects of a second subset of said data objects at
10 the first cache as secondary content, wherein a second cache in the cluster owns
11 said second subset;
12 receiving at a first cache of a plurality of cooperating caches a first data
13 object of a domain of data objects;
14 if said first data object is owned by the first cache, storing said first data
15 object as primary content in the first cache; and
16 if said first data object is owned by another cache in the plurality of
17 caches, determining on the basis of a set of dynamic criteria whether to store said
18 first data object as secondary content in the first cache;
19 wherein said first data object is owned by one and only one of the plurality
20 of caches; and
21 wherein a ratio between primary content and secondary content in the first
22 cache is allowed to fluctuate;
23 receiving at the first cache a first request for a first data object in said
24 second subset of data objects;
25 receiving said first data object from the second cache; and
26 caching said first data object at the first cache only if said first data object
27 satisfies one or more of a predetermined set of criteria;
28 wherein each of the plurality of cooperating caches in the system is
29 configured to save previous configurations of the cache system, so that when the

30 | configuration of the cooperating caches changes, the system can quickly revert to
31 | a saved configuration; and
32 | wherein knowledge of previous configurations and content digests sent by
33 | cooperating caches are used to operate a warm-up phase that allows new caches to
34 | initiate rapidly as they enter the system.

1 127. (Currently amended) A method of caching data objects in a plurality
2 of cooperating caches, comprising:
3 partitioning a domain of data objects among a plurality of cooperating
4 caches, wherein a first cache receives ownership of a first subset of said data
5 objects;
6 caching one or more members of said first subset of data objects at the
7 first cache;
8 caching one or more members of a second subset of data objects at the
9 first cache as secondary content, wherein a second cache owns said second subset
10 of data objects;
11 wherein a ratio of members of the first subset to members of the second
12 subset is allowed to fluctuate; ~~and~~
13 removing a first cached data object from said first cache, wherein said first
14 data object is identified by applying a predetermined set of criteria;
15 wherein each of the plurality of cooperating caches in the system is
16 configured to save previous configurations of the cache system, so that when the
17 configuration of the cooperating caches changes, the system can quickly revert to
18 a saved configuration; and
19 wherein knowledge of previous configurations and content digests sent by
20 cooperating caches are used to operate a warm-up phase that allows new caches to
21 initiate rapidly as they enter the system.

1 128. (Previously presented) The method of claim 127, wherein said
2 predetermined set of criteria includes data object popularity.

1 129. (Previously presented) The method of claim 127, wherein said
2 predetermined set of criteria includes data object validity.

1 130. (Previously presented) The method of claim 127, wherein said
2 predetermined set of criteria includes data object size.

1 131. (Previously presented) The method of claim 127, wherein said
2 predetermined set of criteria includes data object age.

1 132. (Previously presented) The method of claim 127, wherein said
2 predetermined set of criteria includes data object ownership.

1 133. (Previously presented) The method of claim 127, wherein said
2 predetermined set of criteria includes a cost of retrieving a data object from an
3 origin server.

1 134. (Previously presented) The method of claim 127, wherein said
2 predetermined set of criteria includes a measure of the utilization of the first
3 cache.

1 135. (Previously presented) The method of claim 127, further comprising:
2 receiving at the first cache an invalidation message regarding a data object
3 cached in the first cache; and
4 communicating said invalidation of said data object to another cache.

1 136. (Currently amended) A computer readable storage medium storing
2 instructions that, when executed by a computer, cause the computer to perform a
3 method of caching data objects in a plurality of cooperating caches, the method
4 comprising:

5 partitioning a domain of data objects among a plurality of cooperating
6 caches, wherein a first cache receives ownership of a first subset of said data
7 objects;

8 caching one or more members of said first subset of data objects at the
9 first cache;

10 caching one or more members of a second subset of data objects at the
11 first cache as secondary content, wherein a second cache owns said second subset
12 of data objects;

13 wherein a ratio between primary content and secondary content in the first
14 cache is allowed to fluctuate; and

15 removing a first cached data object from said first cache, wherein said first
16 data object is identified by applying a predetermined set of criteria;

17 wherein each of the plurality of cooperating caches in the system is
18 configured to save previous configurations of the cache system, so that when the
19 configuration of the cooperating caches changes, the system can quickly revert to
20 a saved configuration; and

21 wherein knowledge of previous configurations and content digests sent by
22 cooperating caches are used to operate a warm-up phase that allows new caches to
23 initiate rapidly as they enter the system.

1 137. (Currently amended) A hybrid cache, comprising:

2 a cache engine configured to cache a first subset of a domain of data
3 objects, wherein ownership of said first subset of data objects is assigned to the
4 hybrid cache;

5 a monitor configured to monitor an operational status of the hybrid cache;

6 an administrator configured to facilitate administration of the hybrid
7 cache; and
8 communication links coupling the hybrid cache to one or more other
9 hybrid caches;
10 wherein said cache engine is further configured to cache a second subset
11 of a domain of data objects owned by a second hybrid cache as secondary content
12 if said second data object satisfies a set of dynamic criteria;
13 wherein a ratio between the first subset of data objects and the second
14 subset of data objects in the first cache is allowed to fluctuate;
15 wherein each of the plurality of cooperating hybrid caches in the system is
16 configured to save previous configurations of the cache system, so that when the
17 configuration of the cooperating caches changes, the system can quickly revert to
18 the saved configuration; and
19 wherein knowledge of previous configurations and content digests sent by
20 cooperating caches are used to operate a warm-up phase that allows new caches to
21 initiate rapidly as they enter the system.

1 138. (Previously presented) The hybrid cache of claim 137, wherein said
2 domain of data objects is partitioned among the hybrid cache and the other hybrid
3 caches such that each said cacheable data object is owned by just one of the
4 hybrid caches.

1 139. (Previously presented) The hybrid cache of claim 137, wherein said
2 dynamic criteria include one or more of: popularity, validity, age, size, ownership
3 and cost of retrieving said second data object.

1 140. (Previously presented) The hybrid cache of claim 137, wherein one
2 or more of said cache engine and said monitor are configured to report the
3 invalidation of said second data object to the second hybrid cache.

1 141. (Currently amended) A cluster of hybrid caches, comprising:
2 a plurality of hybrid caches;
3 a set of data objects, wherein ownership of said data objects is partitioned
4 among said hybrid caches; and
5 a set of criteria for applying to determine whether to cache as primary
6 content at a first hybrid cache a data object owned by a second hybrid cache;
7 wherein each of said hybrid caches is configured to always cache a first
8 received data object that it owns and to apply said set of criteria to determine
9 whether to cache a second received data object as secondary content that belongs
10 to a different hybrid cache, and if so, store said first data object as secondary
11 content in the first hybrid cache;
12 wherein a ratio between primary content and secondary content in the first
13 cache is allowed to fluctuate;
14 wherein each of the plurality of cooperating caches in the system is
15 configured to save previous configurations of the cache system, so that when the
16 configuration of the cooperating caches changes, the system can quickly revert to
17 a saved configuration; and
18 wherein knowledge of previous configurations and content digests sent by
19 cooperating caches are used to operate a warm-up phase that allows new caches to
20 initiate rapidly as they enter the system.